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(54) Title: VOICE/POINTER OPERATED SYSTEM
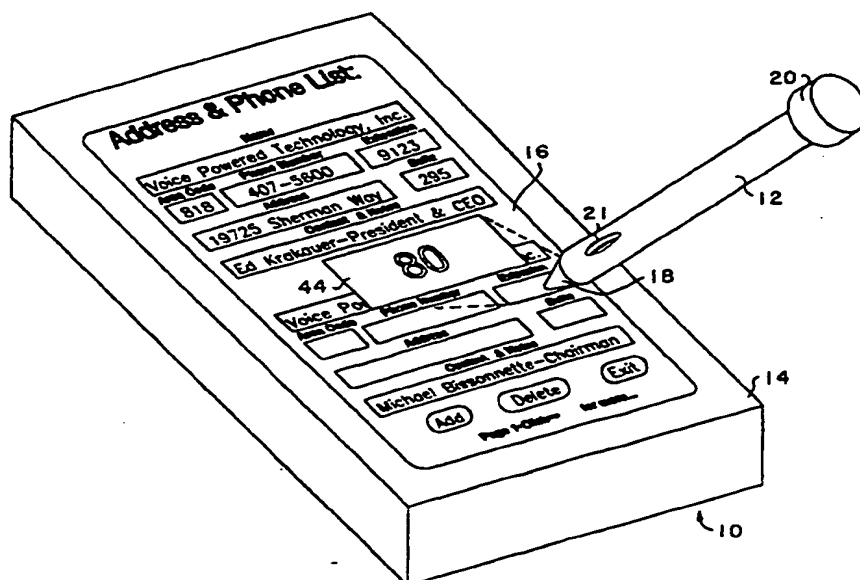
(57) Abstract

A voice and pointer operated system includes a pen (12) provided with a microphone (20) responsive to a voice command for providing a voice signal and an electronic device (14) having a pointer-responsive area in the form of a touch screen (16) thereon for interfacing with the pen (12) as well as apparatus for recognizing the voice signal and producing an action routine denoted thereby. The pointer responsive area (16) may comprise a touch screen presenting frames for interaction with the pen (12) to select function for the electronic device (14) with voice commands entered via the microphone (20) in the pen being used to provide input data to the electronic device (14). The pen (12) may be wireless or electrically coupled to the electronic device (14).

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VOICE/POINTER OPERATED SYSTEM
Background of the Invention

1. Field of the Invention.

The present invention relates to systems for
entering data into a device using voice recognition of
spoken words, and more particularly to systems capable
of combining voice recognition with other forms of data
entry such as by touching.

2. History of the Prior Art.

It is well known to provide an electronic device
with a pointer member such as a pen or stick for
purposes of inputting data into the device. Typically,
the pen or stick is used to activate buttons and to
highlight fields displayed on touch-screen displays.
In addition, the pen or stick may be used to perform
other functions, such as handwriting recognition. In
such arrangements, the pen or stick provides a means of
human interfacing whereby the operator may point to
fields, frames or buttons to make selections or
otherwise enter data into an electronic device, such as
a personal computer, a personal organizer or a personal
digital assistant (PDA). Additional data, such as that
entered for purposes of recording or storage, is often
entered by other interfacing means such as a keyboard
or keypad.

Still other arrangements for inputting data into an
electronic device are known. Among such arrangements
are those which use voice recognition techniques to
recognize voice commands entered by the user. Such
electronic devices include systems in which remote
controls are provided with sophisticated voice
recognition electronics. The remote controls recognize
spoken commands, translate the commands into the
traditional remote digital control signals, and
transmit the control signals to a controlled device.
Examples of such systems are provided by co-pending
application Serial No. 07/915,112 of Bissonnette et

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al., entitled Voice Operated Remote Control Device, by
co-pending application Serial No. 07/915,938 of
Bissonnette et al., entitled Voice Recognition
Apparatus and Method, and by co-pending application
5   Serial No. 07/915,114 of Fischer, entitled Remote
Control Device. All three applications were filed on
July 17, 1992 and are commonly assigned with the
present application.

A further example of an electronic device in which
10   data is inputted using voice recognition is provided by
co-pending application Serial No. 08/113,394 of Fischer
et al., entitled Voice Operated Remote Control System,
which application was filed August 27, 1993 and is
commonly assigned with the present application. The
15   Fischer et al. application describes a voice operated
remote control system in which a remote control device
responsive to the voice commands of a user transmits
representations of the voice commands to a controlled
device which then produces voice signals in response to
20   the transmitted representations. The controlled device
includes voice recognition circuitry for recognizing
the transmitted voice commands and executing action
routines denoted thereby. The remote control device
receives the voice commands via a microphone and
25   produces a corresponding analog audio signal which is
modulated and then transmitted by an infrared
transmitter. An audio receiver at the controlled
device includes an infrared sensor for receiving the
transmitted signal, and additional circuitry for
30   demodulating and processing the transmitted signal into
a corresponding voice signal. The voice signal is used
to generate an incoming digital voice template for
comparison with a plurality of digital reference voice
templates. If a substantial equivalent is found, a
35   corresponding action routine is executed to achieve a
desired action within the controlled device.

Another electronic device utilizing voice
recognition for data inputting is described by co-
pending application Serial No. 08/134,327 of
Bissonnette et al., entitled Voice Activated Personal

5   Organizer, which application was filed October 12, 1993
and is commonly assigned with the present application.
The Bissonnette et al. application describes a small,
portable, hand-held electronic personal organizer which
performs voice recognition on words spoken by a user to

10   input data into the organizer, and records voice
messages from the user. The spoken words and the voice
messages are input via a microphone, and the voice
messages are compressed and then converted into digital
signals for storage. The stored digital voice messages

15   are reconverted into analog signals and then expanded
for reproduction using a speaker. The organizer is
capable of a number of different functions, including
voice training, memo record, reminder, manual reminder,
time setting, message review, waiting message,

20   calendar, phone group select, number retrieval, add
phone number, security, and "no" logic. During such
functions, data is principally entered by voice and
occasionally through use of a limited keypad, and voice
recordings are made and played back as appropriate. A

25   visual display provides feedback to the user. During
the various functions, the user can edit different data
within the organizer by eliminating or correcting such
data or entering new data.

    While the electronic devices described in the

30   above-noted co-pending applications incorporate a
number of different advantageous features for human
interfacing with such electronic devices so that data
can be efficiently and effectively transferred, it may
be desired for certain applications to provide further

35   improvements in human interfacing with such devices.
For example, it would be desirable to be able to select
functions or otherwise input data via manual means

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while simultaneously entering data specific to those
functions by non-manual entries such as by vocal
commands. Such an arrangement would provide an easy,
intuitive human interface, allowing for both
5   simultaneous and independent speech and touch
inputting.

Brief Summary of the Invention

Briefly stated, the present invention provides a
voice and pointer operated system in which a pen or
10   stick responsive to voice commands is operative to
input data into a device using voice recognition, in
addition to data inputted into the device using a
pointer or tip region of the pen or stick. The device
has a pointer-responsive area thereon as well as voice
15   recognition means for recognizing a voice signal from
the pen and producing an action routine denoted
thereby. The pointer-responsive area may comprise a
touch screen presenting frames for interaction with the
pen to select functions for the device, with voice
20   commands entered via a microphone in the pen being used
to provide input data to the device.

In a first embodiment of a voice and pointer
operated system in accordance with the invention, the
pen is electrically coupled to the device to provide
25   the voice signal directly to the device. A wire
extending between the pen and the device, and which is
long enough to permit movement of the tip region of the
pen to different areas of the touch screen, couples the
microphone directly to the device to provide the voice
30   signals thereto. The wire connection also enables the
pen to utilize the power supply of the device.

In a second embodiment of a voice and pointer
operated system, the pen is wireless, thereby
eliminating the need for a wire or other direct
35   connection between the pen and the device. Voice
signals generated by the microphone of the pen in
response to voice commands from the user are modulated

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before being transmitted by the pen to an audio
receiver within the device for conversion into the
voice signal. The modulated voice signal may be
transmitted by an infrared transmitter, within the pen,
5   to an infrared sensor at the audio receiver within the
device.

The voice recognition apparatus within the device
may assume any appropriate form. In one example, such
apparatus includes a reference memory for storing a
10   plurality of reference voice templates, a program
memory for storing a control program, and a processor
for generating an incoming voice template in response
to each voice signal which is received, in order to
produce a voice signal corresponding to the transmitted
15   representation. The control program is executed to
determine whether the incoming voice template is
substantially equivalent to one of the reference voice
templates. One of a plurality of action routines is
then selected, based on the reference voice template
20   which the incoming voice template matches.

The device, which is controlled by the voice and
pointer inputs of the pen or stick, may comprise such
electronic devices as a computer, a personal organizer
or a personal digital assistant (PDA). The device may,
25   for example, comprise a personal digital assistant
which is organized to operate as a phone directory for
storing names, addresses, phone numbers and other
information. In that event, various fields within a
display on the phone directory are touched by the pen
30   to select basic functions such as entry of an
additional name or entry of digital information for a
name already displayed, with the user then speaking
into the pen to enter the specific data within such
fields.

35   Brief Description Of The Drawings

The foregoing and other objects, features and
advantages of the invention will be apparent from the

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following more particular description of preferred
embodiments of the invention, as illustrated in the
accompanying drawings, in which:

5   Fig. 1 is a perspective view of a pen and a
personal digital assistant, providing an example of a
voice and pointer operated system in accordance with
the invention;

         Fig. 2 is a block diagram of a first embodiment of
the system of Fig. 1 in which the pen is directly
10   coupled by wire to the personal digital assistant;

         Fig. 3 is an alternative embodiment of the system
of Fig. 1 in which the pen is wireless;

         Fig. 4 is a block diagram of the electronic portion
of the pen of Fig. 3;

15   Fig. 5 is a block diagram of the audio receiver
forming a part of the personal digital assistant of
Fig. 3;

         Fig. 6 is a basic flow chart illustrating the
operation of the system of Fig. 1; and

20   Fig. 7 is a detailed flow chart illustrating a
detailed example of the operation of the system of Fig.
1.

                    Detailed Description

         Fig. 1 shows a voice and pointer operated system 10
25 in accordance with the invention. The system 10 of
Fig. 1 includes a pen 12 and electronic device 14 with
which the pen 12 is used. In the example of Fig. 1,
the device 14 comprises a personal digital assistant
(PDA). It should be appreciated, however, that systems
30 in accordance with the invention may utilize other
electronic devices such as computers and personal
organizers which are adapted for voice and pointer
operation, using the pen 12, in accordance with the
invention.

35   The electronic device 14 includes a pointer-
responsive area thereon in the form of a touch-screen
16. The pen 12 includes a pointer or tip region 18

thereof. Placement of the pen 12 to engage the touch-
screen 16 by the tip region 18 results in the inputting
of data into the touch-screen 16 in conventional
fashion. In this connection, it should be understood

5 that arrangements using other than physical touching
can be used in accordance with the invention, including
those in which the pointer-responsive area responds to
infrared signals blocked by the pen 12. Any
appropriate arrangement can be used in which the tip

10 region 18 of the pen 12 interacts with the touch-screen
16 or other pointer-responsive area of the device 14 to
input data therein, when placed in close proximity
thereto.

In accordance with the invention, the pen 12 is

15 provided with a microphone 20 mounted at an end of the
pen 12 opposite the tip region 18. As the user speaks
voice commands into the microphone 20, corresponding
voice signals are provided to the device 14. The user
presses a push-to-talk switch 21 on the pen 12 to

20 signal the device 14 that voice commands are being
transmitted thereto. As described hereafter, the
device 14 utilizes voice recognition to input further
data represented by the voice signals.

The pen 12 may be directly coupled to the device 14

25 by wire, as described hereafter in connection with Fig.
2. Alternatively, the pen 12 may be wireless and may
transmit the voice commands to the device 14, such as
by use of infrared techniques, as described hereafter
in connection with Fig. 3. The manner in which the

30 voice signals received by the microphone 20 of the pen
12 are conveyed to the device 14 is unimportant. What
is important is that the system 10 of Fig. 1, as is
true of systems in accordance with the invention, be
capable of inputting data into the device 14 using both

35 voice commands and pointing. Moreover, the voice
commands and the pointing can be utilized to input data
into the device 14 simultaneously.

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It will be appreciated by those skilled in the art, particularly from the detailed description to follow, that systems in accordance with the invention such as the system 10 shown in Fig. 1 provide a greatly

5   improved, and indeed a natural, human interface of the user with the device 14. The pen 12 can be used to point to a desired field or other area of the device 14, and thereby input data into the device 14 while simultaneously responding to the user's voice commands

10   to input additional data into the device 14 in conjunction therewith. This enables the user to point to a desired field or frame of the touch-screen 16 within the device 14 while at the same time making choices and otherwise inputting data in connection with

15   such field or frame using voice commands.

Fig. 2 shows an embodiment of the system 10 of Fig. 1 in which the pen 12 is directly coupled by wire to the device 14. As shown in Fig. 2, the microphone 20 of the pen 12 is coupled by a wire 22 to the device 14.

20   The wire 22, which is long enough to provide the user with flexibility in pointing to different portions of the touch-screen 16, provides the voice signals which are generated by the microphone 20 in response to the voice commands of the user directly to a

25   microcontroller 24 within the device 14. The user presses the push-to-talk switch 21 before speaking to signal the device 14 that voice signals are being transmitted thereto.

The microcontroller 24 forms a part of a voice

30   recognition circuit 26, and includes an analog-to-digital converter (A/D) 28. The microphone 20 of the pen 12 converts words spoken by the user into analog voice signals, and the A/D converter 28 converts such signals into corresponding digital signals. The

35   microcontroller 24 also includes a microprocessor (MP) 30 coupled to the A/D converter 28, and having access to both a read only memory (ROM) 32 and a random access

memory (RAM) 34. The microcontroller 24 is coupled to
an external DRAM 36, which forms a part of the voice
recognition circuit 26, and which is utilized for voice
recognition storage requirements, including primarily
the storage of voice templates.

The voice recognition apparatus shown and described
in Fig. 2 is by way of example, and it should be
understood that other apparatus capable of voice
recognition can be used in accordance with the
invention. For example, a digital signal processor
(DSP) can be used to perform the voice recognition.

The microcontroller 24 comprising the voice
recognition circuit 26 operates in the same manner as
described in the previously referred to co-pending
applications, Serial Nos. 07/915,112, 07/915,938 and
07/915,114. Such applications are incorporated herein
by reference. As described in detail in co-pending
application Serial No. 07/915,112, for example, the A/D
converter 28 of Fig. 2 may comprise an 8-bit converter
which samples incoming data at a preassigned frequency
such as 9.6 KHz. The A/D converter 28 outputs a
digital signal representing the input analog voice
signal from the microphone 20. The microprocessor 30
processes the digital voice signal together with a
voice recognition software routine forming part of a
control program stored in the ROM 32. The digital
voice signal is converted into an incoming voice
template that is compared against previously stored
voice templates of the user's voice stored in the
external DRAM 36. The program decodes the voice
templates. Together with the external DRAM 36, the RAM
34 comprises a reference memory for temporary storage
of data.

Thus, the analog voice signal from the microphone
20 of the pen 12 is applied to the A/D converter 28 for
conversion into an incoming digital voice signal. The
reference memory, comprised of the external DRAM 36 in

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conjunction with the RAM 34, stores a plurality of
reference digital voice templates. The ROM 32 stores
the control program. The microprocessor 30, which is
coupled to the A/D converter 28, the ROM 32 and the RAM

5   34, generates an incoming digital voice template from
the incoming digital voice signal at the output of the
A/D converter 28. The microprocessor 30 then executes
the control program to determine whether the incoming
digital voice template is substantially equivalent to

10 one of the reference digital voice templates stored in
the reference memory comprised of the RAM 34 and the
external DRAM 36. The microprocessor 30 determines
what action to take corresponding to a reference
digital voice template, if the incoming digital voice

15 template is found to have substantial similarity to the
reference digital voice template. Again, however, it
should be understood that this description is by way of
example only, and that other voice recognition
techniques can be used in accordance with the

20 invention.

The electronic device 14 includes a keyboard input
38. The keyboard input 38 is not essential but may be
used, as in the present example, for manual entry of
additional data into the microcontroller 24. The

25 electronic device 14 also includes an audio circuit 40
coupled through a speaker or speakers 42 to provide
audible messages to the user of the device 14.

The electronic device 14 of Fig. 2 includes a
liquid crystal display (LCD) 44 coupled to the

30 microcontroller 24 through an LCD display circuit 46.
The LCD display 44, which provides a visual display to
the user, forms part of the touch-screen 16 of the
electronic device 14. The touch-screen 16 is
responsive to the tip region 18 of the pen 12 to input

35 data, with such data being provided to the
microcontroller 24 by the LCD display circuit 46. The
physical or touching relationship between the tip

region 18 of the pen 12 and the touch-screen of the LCD
display 44 is represented by a dotted line 48 in Fig.
2.

The touch-screen 16 of the device 14 responds to
5   the tip region 18 of the pen 12 to input data into the
device 14 in conventional pen or stick fashion. In
addition, however, and in accordance with the
invention, data is also input into the device 14 using
the microphone 20 of the pen 12 and the voice
10   recognition capabilities of the device 14. As
previously described, the microphone 20 responds to
vocal commands of the user by providing the analog
voice signals to the microcontroller 24 comprising a
portion of the voice recognition circuit 26. The
15   microcontroller 24 attempts to recognize the voice
signals, and when such recognition occurs additional
data is input into the system. In this fashion, data
inputted into the device 14 by voice command is
combined with data input by touching the touch-screen
20   16.

Fig. 3 shows an alternative embodiment in which the
pen 12 is not coupled by the wire 22 to the device 14,
as in the case of Fig. 2. Instead, the pen 12 is
wireless and transmits representations of the voice
25   commands of the user to an audio receiver 50 within the
device 14. The audio receiver 50 in turn converts the
transmitted signals into the voice signals for
application to the microcontroller 24. The
microcontroller 24 performs voice recognition on the
30   voice signals in the same manner as described in
connection with Fig. 2.

Thus, the device 14 of Fig. 3 is like that of Fig.
2, except for the presence of the audio receiver 50.
The pen 12 of Fig. 3 is like the pen of Fig. 2, except
35   that it transmits the vocal commands to the audio
receiver 50 in wireless fashion. Because the pen 12 of
Fig. 3 is not directly coupled to the device 14 of Fig.

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3 by wire, the pen 12 must have its own power supply.
To conserve on power, the push-to-talk switch 21 which
is mounted on the side of the pen 12 is used to apply
power to the microphone 20 whenever the user wishes to
5   speak into the microphone 20. As in the case of Fig.
2, the tip region 18 of the pen 12 of Fig. 3 physically
interacts with the touch-screen 16 formed in
conjunction with the LCD display 44, as represented by
the dotted line 48.

10   The electronic portion of the pen 12 of Fig. 3 is
shown in Fig. 4. As previously described, the
microphone 20 responds to words spoken by the user to
produce the analog voice signals. Such analog voice
signals are amplified in an audio amplifier 54. The
15   audio amplifier 54 conditions the signal for proper
application to a voltage controlled oscillator (VCO) 56
to frequency modulate (FM) a signal at the output of
the VCO 56 in accordance with the analog audio signal
from the amplifier 54. The output of the VCO 56 is
20   conditioned by a driver circuit 58 prior to driving an
infrared (IR) transmitter 60.

The pen 12 is powered by batteries 62. Because
there is no memory or microprocessor in the pen 12,
there is no need to keep the pen 12 powered when not in
25   use. Accordingly, the push-to-talk switch 21 is used
to provide the power from the batteries 62 only when
the user wishes to speak into the microphone 20.
Pressing the push-to-talk switch 21 at the outer
surface of the pen 12 couples the batteries 62 to a
30   voltage regulator 64. The voltage regulator 64, which
is coupled between a common ground line 66 and the
push-to-talk switch 21, has an output terminal 68
thereof coupled to provide a power supply voltage (+V)
at a terminal 70. This regulated supply voltage is
35   applied to the microphone 20, the audio amplifier 54
and the VCO 56. The batteries 62 are directly coupled
to the driver 58 by the push-to-talk switch 21. The

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regulated supply voltage +V optimizes the operating
conditions of the VCO 56.

Whenever the user wishes to transmit a voice
command to the electronic device 14, the user pushes

5   the push-to-talk switch 21 and speaks the voice command
into the microphone 20 of the pen 12. The resulting
analog audio signal is amplified by the amplifier 54
and applied to the VCO 56 to frequency modulate the
output of the VCO 56. This FM signal is applied via

10   the driver 58 to the infrared transmitter 60, for
transmission as an infrared signal to the electronic
device 14. When the user is not transmitting voice
commands, the push-to-talk switch 21 is open, and the
batteries 62 are not coupled to the voltage regulator

15   64 or to the driver 58.

When the user pushes the push-to-talk switch 21 and
speaks a command word into the microphone 20, the pen
12 transmits a frequency modulated infrared signal from
the infrared transmitter 60. The infrared transmitter

20   60 may comprise an infrared diode or other appropriate
infrared transmitting device. Such infrared signals
are sensed by an infrared (IR) sensor 72 forming a part
of the audio receiver 50, as shown in Fig. 3. A
detailed example of the audio receiver 50 is shown in

25   Fig. 5.

Referring to Fig. 5, the infrared sensor 72, which
may comprise any appropriate form of infrared sensor
such as those typically used in remote control devices,
provides the received signal for amplification by an

30   amplifier 74 and filtering by a filter 76. The output
of the filter 76 is applied to a phase-locked loop
receiver 78 which demodulates the frequency modulated
signal by converting it to a voice signal. The phase-
locked loop receiver 78 is of conventional phase-locked

35   loop (PLL) configuration, and includes a phase detector
80 coupled to the filter 76 and having an output and a
second input coupled in a loop which includes a loop

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filter 82 and a voltage controlled oscillator (VCO) 84.
The output of the phase-locked loop receiver 78 is
filtered by an audio filter 86 and amplified by an
audio amplifier 88 to provide the demodulated voice
5   signal. The phase-locked loop receiver 78 also
provides a lock detect signal, which indicates when a
transmitted signal is present in the audio receiver 50.

The phase-locked loop receiver 78 is described
10   herein by way of example only, and it should be
understood that other demodulation receivers can be
used as desired. For example, a super-heterodyne
receiver can be used in applications posing more
stringent requirements.
15   Voice control of the electronic device 14 within
the voice and pointer operated system 10 is made
possible by first voice training the collection of
reference digital voice templates in the voice
recognition circuit 26 in accordance with the user's
20   voice. Such templates are collected in the same manner
as described in co-pending application Serial No.
07/915,112. The LCD display 44 of the device 14 is
used to provide displays which prompt the user by
requesting the needed words. The user responds, with
25   the push-to-talk switch 21 being pushed, by speaking
the prompted word into the microphone 20 of the pen 12.

As previously noted, the electronic device 14 in
the example of Fig. 1 comprises a personal digital
30   assistant (PDA) capable of input and retrieval of a
phone directory. The LCD display 44 of the device 14
is employed to display a list of names and phone
numbers. By touching a button labeled "add", displayed
on the LCD display 44 with the tip region 18 of the pen
35   12, a blank entry with boxes for the name, voice
training, country code, area code, phone numbers,
address and notes is placed at the end of the list.

The user is also given the option of adding additional phone numbers and alternate addresses per entry, if desired. The user may randomly select fields to input data, by touching such fields with the pen 12. For example, if the user touches a "name" box on the LCD display 44 with the pen 12, the name is input using the keyboard input 38, or by voice, spelling each word. The user can then touch a "voice" button and speak the person's name into the microphone 20 of the pen 12 in order to create a recording of the name. The user can then touch an "area code" box and speak the digits for the area code, or the user can touch the "phone number" box and speak the digits of the phone number, to complete the entry. The various fields are optional and can be selected in any order. If the user decides not to input data into a field, the field is left blank. A detailed example of this operation is provided hereafter in connection with Figs. 6 and 7.

To retrieve a phone number, the user touches a "search" button on the LCD display 44 using the pen 12, and speaks the name of the person the user wishes to call. The person's name, phone number, and any other available information is immediately displayed on the LCD display 44, and the recording of the name is spoken back to the user for confirmation, using the audio circuit 40 and the speaker 42 shown in the arrangements of Figs. 2 and 3. Alternatively, the device 14 can be programmed to speak the phone number and other information or to dial the number if connected to a telephone.

The flow chart of Fig. 6 illustrates the manner in which the user inputs all of the information normally found in an address book. For simplicity of illustration, the flow chart of Fig. 6 shows only one path through the various fields. However, it should be understood that the user can input such information in any order desired.

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Referring to the flow chart example of Fig. 6, in a first step 90 the user requests a new entry in the directory, and does so by touching a button labeled "add" with the pen 12. The user then chooses to input

5   the name first, by touching the "name" field with the pen 12, in a step 92. The "name" field is highlighted, and the user then types the person's name using the keyboard input 38, in a step 94. This highlights the "record" field. The user then holds the push-to-talk

10   switch 21 on the pen 12 and speaks the person's name, in a step 96.

Upon speaking the person's name, in the step 96, the "address" field is highlighted upon release of the push-to-talk switch 21. In a step 98, the user types

15   in the address using the keyboard input 38. Alternatively, the user may record the address by speaking the address into the microphone 20 of the pen 12 in a step 100. As a further alternative, the user can speak the digits of the street number into the pen

20   12, in a step 102, and then type the street name using the keyboard input 38, in a following step 104.

Following entry of the address, the "phone number" field is highlighted. The user may type the phone number using the keyboard input 38, in a step 106.

25   Alternatively, the user may speak the digits of the phone number into the pen 12, in a step 108. As shown by a subsequent step 110, the address entry is automatically saved when an "enter" key on the keyboard entry 38 is pressed, or the push-to-talk switch 21 on

30   the pen 12 is released, or one of the on-screen icons such as "save" or "new entry" is touched.

The flow chart of Fig. 7 provides a more detailed example of the manner in which the user can randomly select fields and input information in any order. For

35   simplicity of illustration, the flow chart of Fig. 7 is confined to entry of a phone number. Nevertheless, the

flow chart of Fig. 7 demonstrates the ease and
flexibility with which the user may enter information.

As illustrated by an elongated box 120 at the top
of Fig. 7, the user has chosen to start a new phone

5   number entry. The user may touch a "country" field, as
illustrated in a step 122. If so, and as illustrated
in a following step 124, the country code field is
highlighted and the device 14 waits for the user to
press the push-to-talk switch 21 on the pen 12 (again

10   assuming the wireless example of Fig. 3). By pushing
the push-to-talk switch 21 on the pen 12, in a step
126, the device 14 is ready to interpret each spoken
word and to append the result to the number in the
country code field, until the push-to-talk switch 21 is

15   released or the field is full, as illustrated in a step
128. Release of the push-to-talk switch 21 results in
the device 14 highlighting the country code field (step
124). If the field is full, the box 120 at the top of
Fig. 7 is returned to.

20   From the starting box 120, the user may also touch
an "area code" field, in a step 130, and this
highlights the area code field and waits for the user
to press the push-to-talk switch 21 in a step 132. If
the user presses the push-to-talk switch 21 in a step

25   134, the device 14 interprets each spoken word and
appends the result to the number in the area code
field, until either the user releases the button or the
field is full, as shown in a step 136. Release of the
push-to-talk switch 21 results in the highlighting of

30   the area code field (step 136). If the field is
filled, the starting box 120 is returned to.

From the starting box 120 at the top of Fig. 7, the
user may also touch a "phone number" field in a step
138, and this highlights the phone number field and

35   causes the device 14 to wait for the user to press the
push-to-talk switch 21, in a step 140. If the user
then presses the push-to-talk switch 21, in a step 142,

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the device 14 interprets each spoken word and appends
the result to the number in the phone number field,
until the user releases the push-to-talk switch 21 or
the field is full, as illustrated in a step 144. If
5   the user releases the push-to-talk switch 21, the phone
number field is highlighted (step 140). If the field
is filled, the starting box 120 is returned to.

As shown by the various lines and arrows in Fig. 7,
from the step 124 in which the country code field is
10   highlighted, the user may move to the step 130 or the
step 138 for highlighting of the area code field or the
phone number field respectively. Similarly, from the
step 132 in which the area code field is highlighted,
the user can move to either the step 138, or to the
15   step 122 in which the country code is highlighted. The
step 140 in which the phone number field is highlighted
can also result in the user moving to either the step
122 or the step 130. This illustrates the flexibility
of the system and the fact that fields can be selected
20   and information input thereto randomly and in any
order.

It is possible for two or more users to use the
same electronic device 14. Each such user trains his
or her voice, with the resulting templates being stored
25   separately from the templates of the other user or
users. Thereafter, and in accordance with one
technique, a particular user initiates use of the
device 14 by speaking his or her name, at an
appropriate word group, and this results in the device
30   14 using that person's voice templates. Once the name
is recognized, the LCD display 44 shows the user's name
and uses that person's voice templates, until the name
is changed. Even if the device 14 is turned off, the
device continues to identify that person and his or her
35   voice templates when again turned on. This technique
for use of the electronic device 14 by multiple users
has the advantage that the electronic device 14 need

not have components added thereto to support the multiple voice capability. Also, the users do not have to remember a number on a switch or other device corresponding to their voice. However, the word groups

5   must be increased by addition of more words, and it is difficult to constantly determine which user's voice templates are currently being used.

Accordingly, an alternative approach to accommodating multiple users of the electronic device

10   14 involves the addition of a multiple position switch to the device 14. Positioning such switch to a number corresponding to a particular one of multiple users results in the device 14 using that person's voice templates.

15   While various forms and modifications have been suggested, it will be appreciated that the invention is not limited thereto but encompasses all expedients and variations falling within the scope of the appended claims.

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WHAT IS CLAIMED IS:

    1. A voice and pointer operated system comprising the combination of:

    a pen responsive to a voice command for providing a
5   voice signal; and

    a device having a pointer-responsive area thereon and including voice recognition means for recognizing the voice signal and producing an action routine denoted thereby.

10   2. A voice and pointer operated system in accordance with claim 1, wherein the pen has a tip region for interacting with the pointer-responsive area of the device and a microphone responsive to the voice command.

15   3. A voice and pointer operated system in accordance with claim 1, wherein the pointer-responsive area of the device comprises a touch screen.

    4. A voice and pointer operated system in accordance with claim 1, wherein the pen is
20   electrically coupled to the device to provide the voice signal thereto.

    5. A voice and pointer operated system in accordance with claim 1, wherein the pen includes means responsive to the voice command for transmitting a
25   representation of the voice command, and the device includes means responsive to the transmitted representation of the voice command for providing the voice signal.

    6. A voice and pointer operated system in
30   accordance with claim 5, wherein the means for transmitting includes an infrared transmitter and the means responsive to the transmitted representation includes an infrared sensor.

7. A voice and pointer operated system in accordance with claim 5, wherein the pen includes means for converting the voice command into an analog signal and means for modulating the analog signal to produce a transmission signal, and the device includes means for demodulating the transmission signal.

8. A voice and pointer operated system in accordance with claim 1, wherein the voice recognition means includes a reference memory for storing a plurality of reference voice templates, a program memory for storing a control program, and a processor coupled to the reference memory and the program memory for generating an incoming voice template in response to each voice signal produced by the means for producing a voice signal corresponding to the transmitted representation, and for executing the control program to determine whether the incoming voice template is substantially equivalent to one of the reference voice templates, and for selecting one of a plurality of action routines based on the incoming voice template.

9. A method of controlling, by voice command and by pointing, a control device, comprising the steps of:
pointing to a specific area of the control device to interact with and input data into the control device; and
responding to a voice command by providing a corresponding voice signal to the control device.

10. A method of controlling in accordance with claim 9, wherein the steps of pointing and responding are carried out simultaneously.

11. A method of controlling in accordance with claim 9, comprising the further steps of responding to the voice signal at the control device by performing voice recognition of the voice signal and providing an action routine to the control device in accordance with the voice recognition performed on the voice signal.

12. A method of controlling in accordance with claim 9, wherein the step of responding to a voice command by providing a corresponding voice signal to the control device comprises the steps of converting the voice command, transmitting the converted voice command to the control device and converting the transmitted converted voice command into a voice signal at the control device.

13. A pen for interacting with a touch screen, comprising the combination of:

an elongated pen having a tip region for interacting with a touch screen; and

means contained within the pen and responsive to a voice command for providing a voice signal.

14. A pen in accordance with claim 13, wherein the means for providing a voice signal comprises a microphone.

15. A pen in accordance with claim 14, wherein the microphone is mounted at an end of the elongated pen opposite the tip region.

16. A pen in accordance with claim 13, wherein the means for providing a voice signal includes means responsive to the voice command for transmitting a corresponding signal.

17. A pen in accordance with claim 13, wherein the means for providing a voice signal includes means responsive to the voice command for producing a corresponding analog voice signal, means for modulating the analog voice signal and means for transmitting the modulated analog voice signal.

18. A device for operating in response to a voice signal and to interaction with a pen comprising the combination of:

    means responsive to the voice signal for performing voice recognition thereon;

    means responsive to the voice recognition for producing an action routine within the device; and

    means responsive to interaction with a pen for performing a function with the device.

19. A device in accordance with claim 18, wherein the means responsive to interaction with a pen includes a touch screen mounted on the device.

20. A device in accordance with claim 18, further comprising means for sensing a transmitted modulated audio signal and means for demodulating a sensed signal to produce the voice signal.

21. A method of making entries in a directory stored in an electronic device, the electronic device including a display having a plurality of touch-responsive fields and means for recognizing words spoken by a user, comprising the steps of:

    touching a name field on the display;

    manually entering a name into the device;

    speaking the name to enter it into the device;

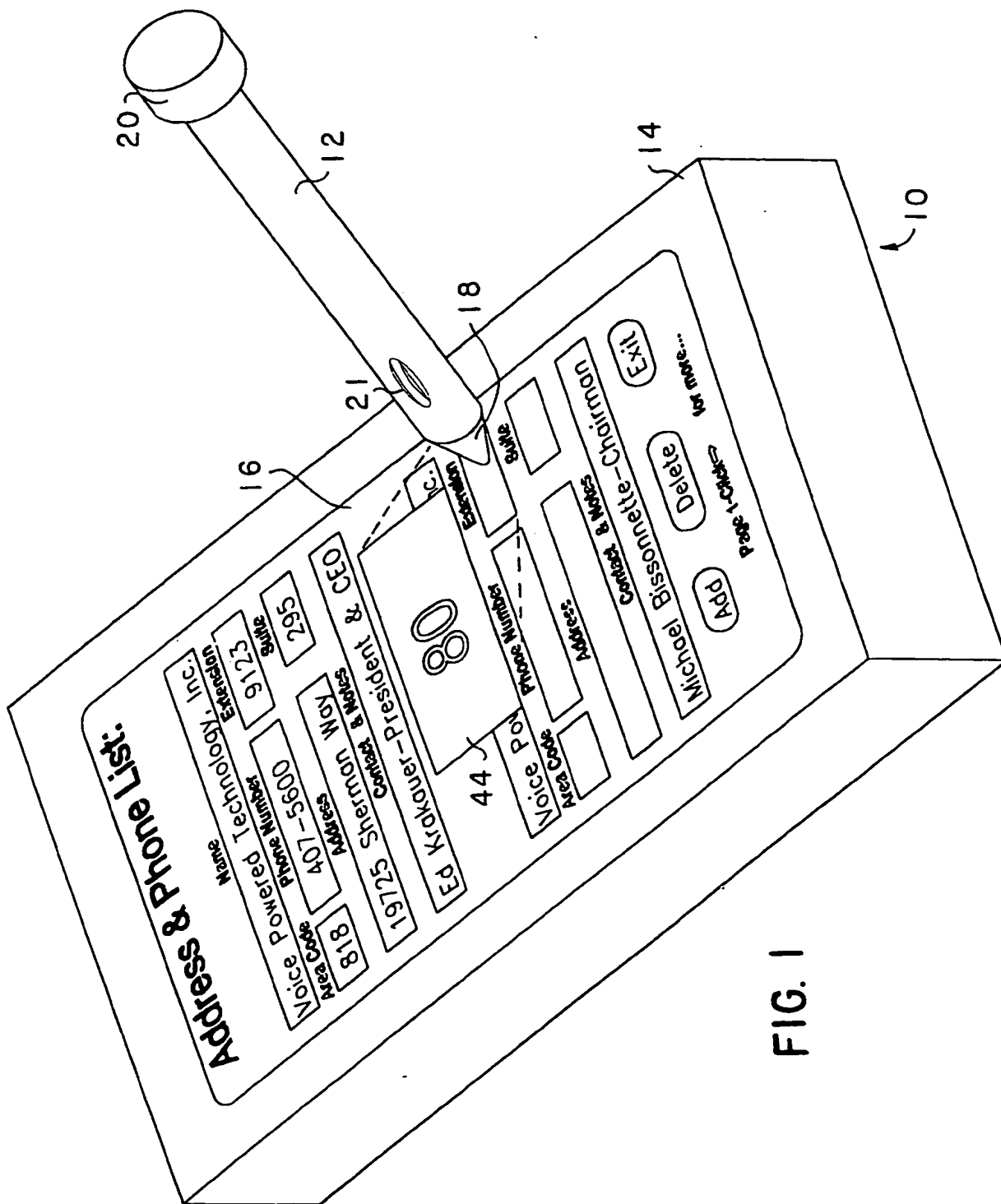   entering an address for the name into the device; and
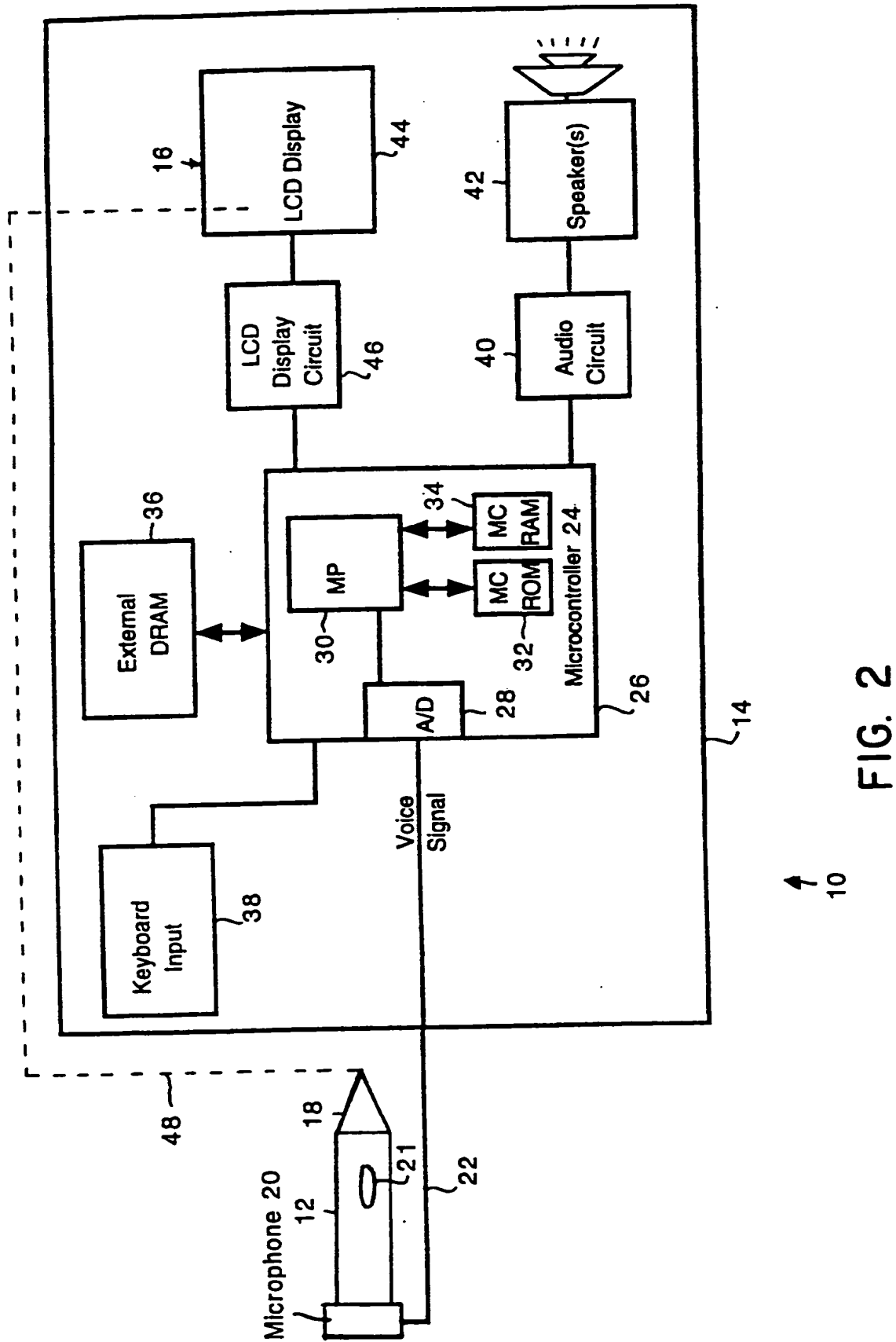
    entering a phone number for the name into the device.

22. A method in accordance with claim 21, wherein the step of touching a name field is carried out using a pen, and the step of speaking the name comprises speaking the name into the pen so that the pen transmits a corresponding voice signal to the device.

23. A method in accordance with claim 22, wherein the step of entering an address for the name comprises speaking the address into the pen so that the pen transmits a corresponding voice signal to the device.

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24. A method in accordance with claim 22, wherein
the step of entering a phone number for the name
comprises speaking the phone number into the pen so
that the pen transmits a corresponding voice signal to
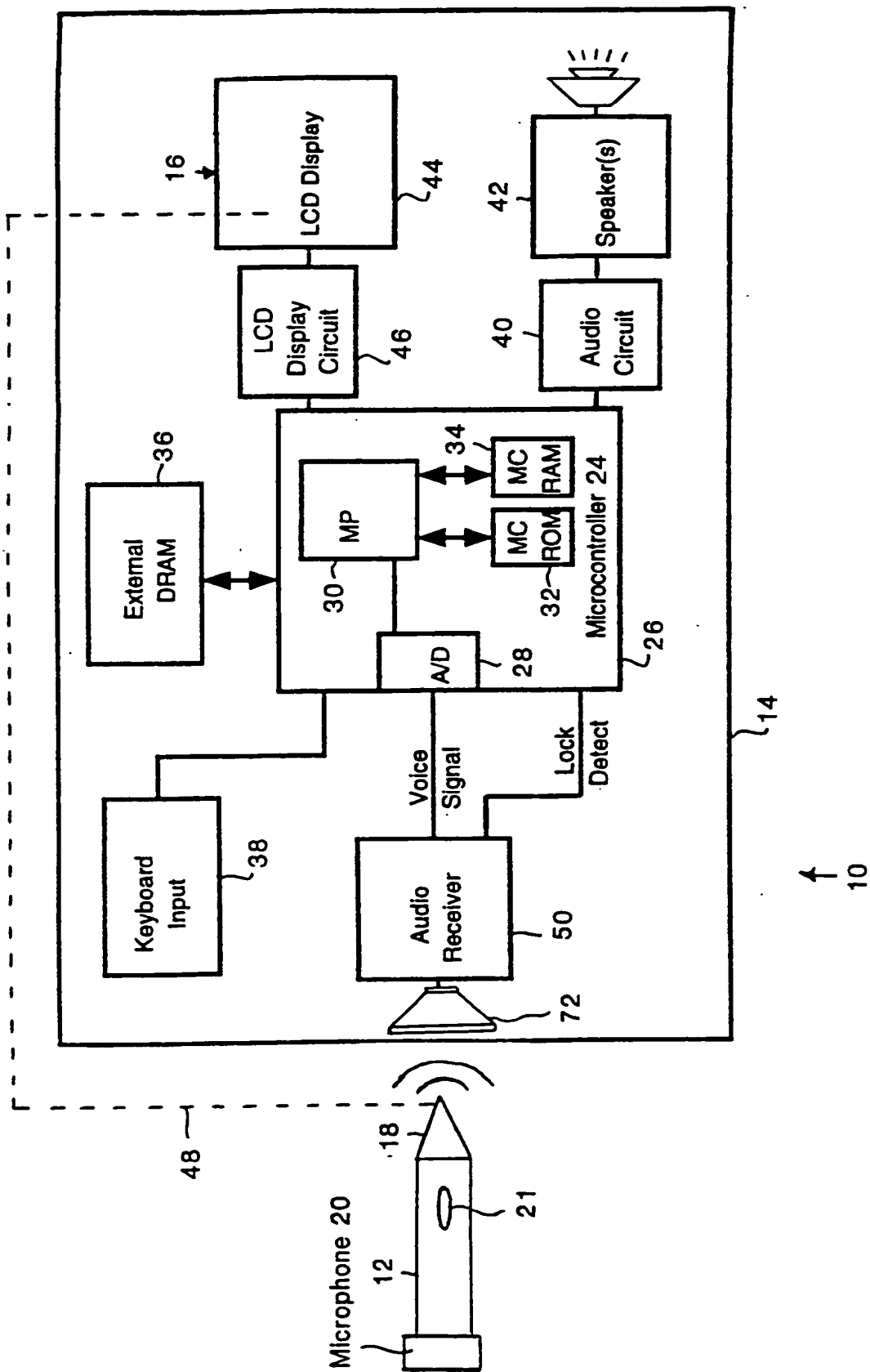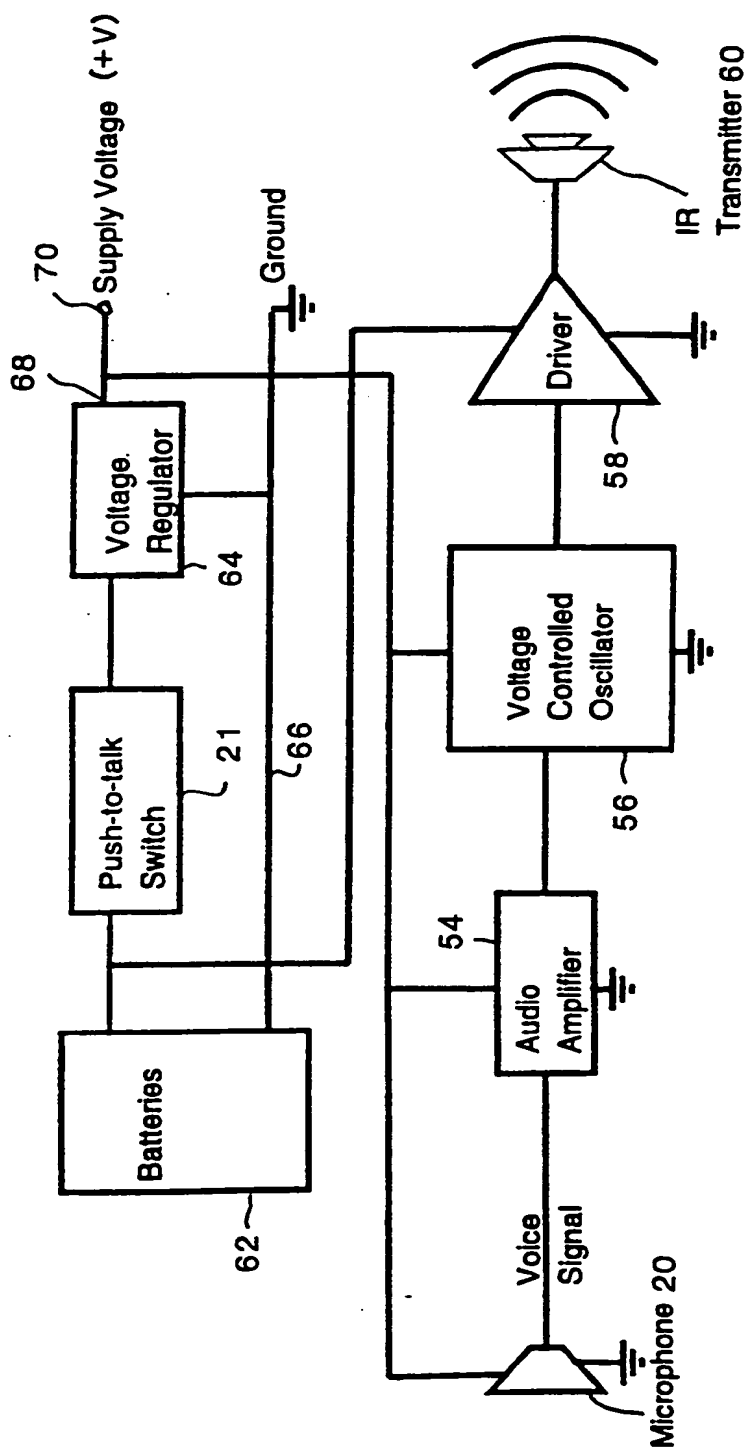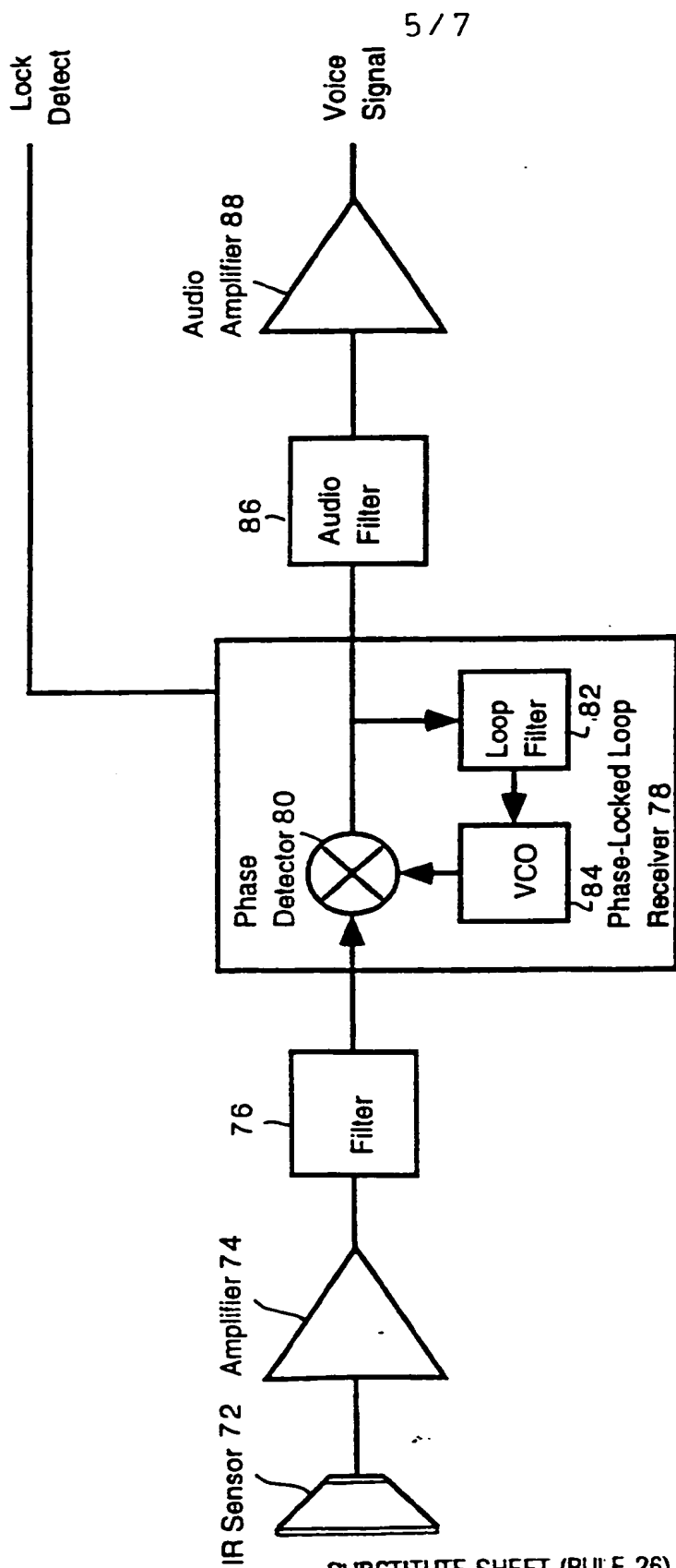5   the device.

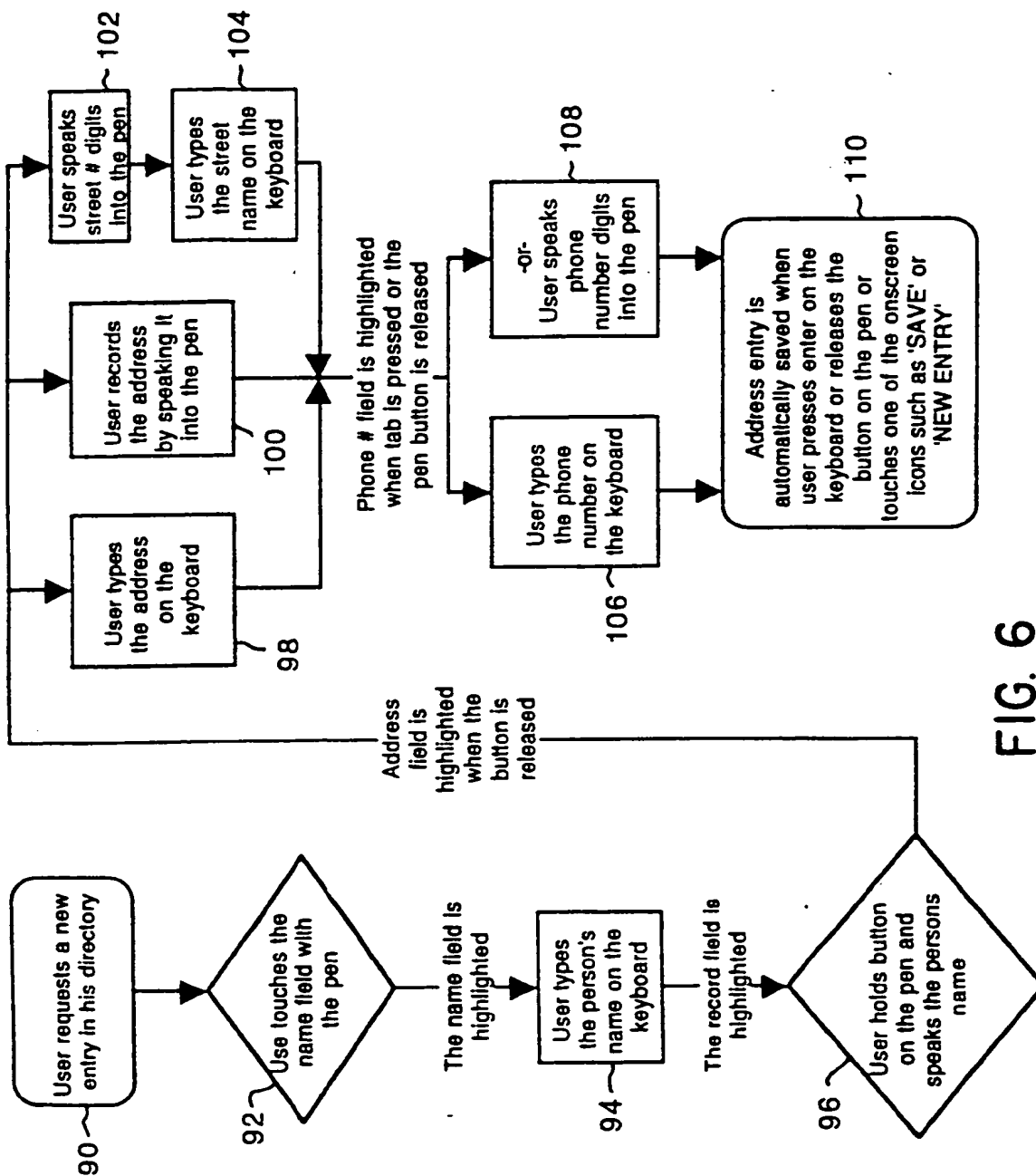## Address & Phone List:

Name			
Voice Powered Technology, Inc.		Extension	Suite
		9123	295

Phone Number
Voice Powered
Area Code	407-5600
818	

Address
19725 Sherman Way

Contact & Notes
Ed Krakauer-President & CEO

8

Phone Number
Voice Po
Area Code	

Address:

Contact & Notes
Michael Bissonnette-Chairman

(Add)   (Delete)   (Exit)

Page 1 of 1 →   for more....

FIG. 1

FIG. 2

FIG. 3

FIG. 4

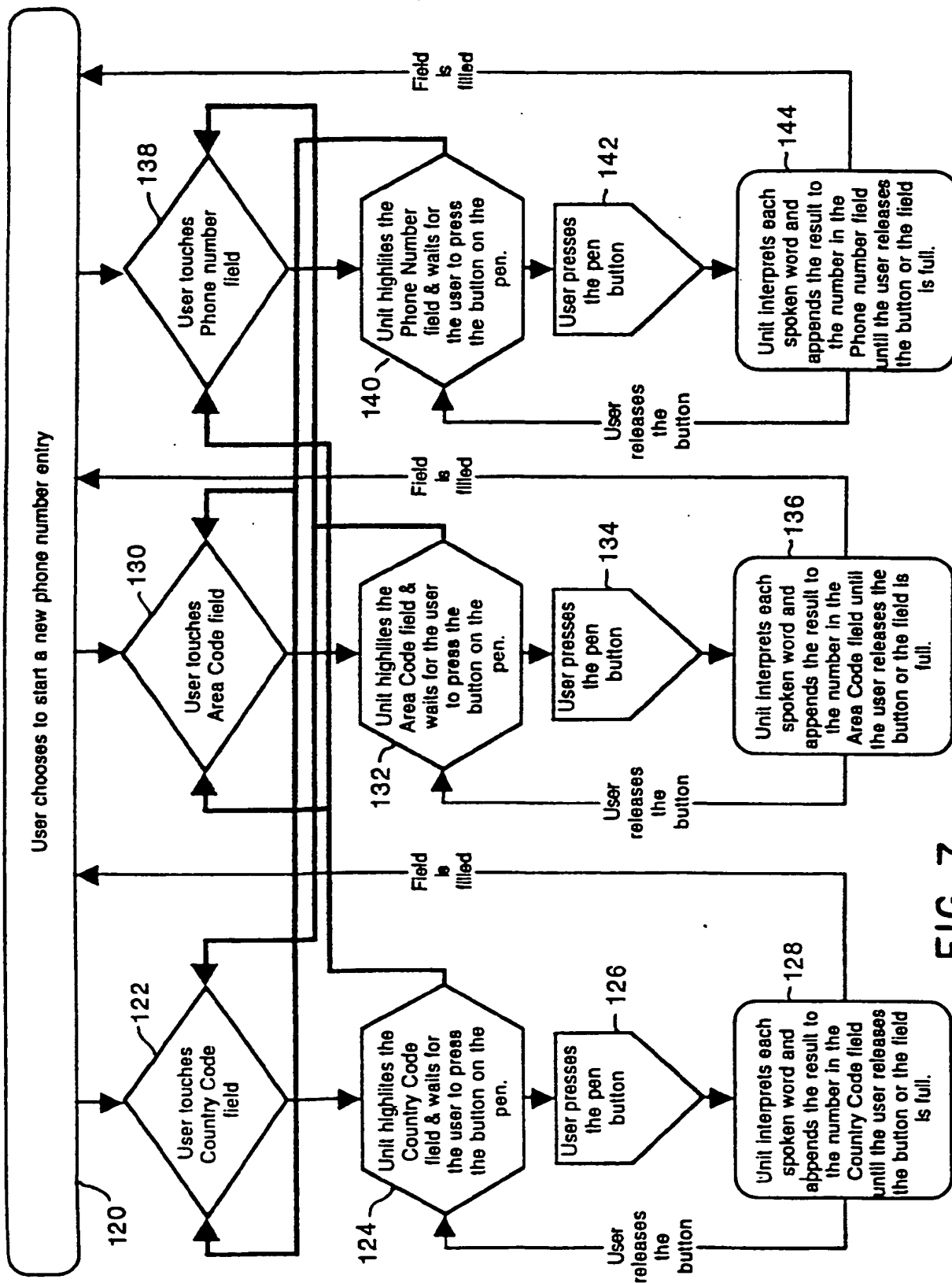FIG. 5

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FIG. 6

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FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US95/02921

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :G10L 9/00
US CL :395/2.4, 2.44

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 395/2.4, 2.44, 2.79, 11, 12

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS, IEEE CD ROM LIBRARY
search terms: PDA, voice command, portable computer, pointing device

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 4,495,646 (GHARACHORLOO) 22 January 1985, Fig 1.	1-20
Y	US, A, 4,811,243 (RACINE) 07 March 1989, Figs 1 and 2, col. 4, lines 46-56.	1-24
Y	US, A, 4,914,704 (COLE ET AL) 03 April 1990, Fig 1.	1-24
A	US, A, 5,063,600 (NORWOOD) 05 November 1991, Fig 1A.	1-24
Y	US, A, 5,148,155 (MARTIN ET AL) 15 September 1992, Fig 1, col. 7, line 39 to col. 8, line 10.	1-24
Y, P	US, A, 5,309,359 (KATZ ET AL) 03 May 1994, Fig 1.	1-24

[X] Further documents are listed in the continuation of Box C.   [ ] See patent family annex.

	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be part of particular relevance		
"E"	earlier document published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed	"&"	document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 APRIL 1995	0 2 JUN 1995

Name and mailing address of the ISA/US	Authorized officer
Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	ALLEN MACDONALD Joni Hill
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Form PCT/ISA/210 (second sheet)(July 1992)*

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y,P	US, A, 5,347,477 (LEE) 13 September 1994, Fig 5.	1-24
A,P	US, A, 5,365,434 (FIGLIUZZI) 15 November 1994, Fig 2.	1-24